Strathmore UNIVERSITY

STRATHMORE BUSINESS SCHOOL
BACHELOR OF COMMERCE
BACHELOR OF SCIENCE SUPPLY CHAIN AND OPERATIONS MANAGEMENT
END OF SEMESTER EXAMINATION
MAT 1101: INTRODUCTION TO BUSINESS MATHEMATICS
MAT 1105: BUSINESS MATHEMATICS

DATE: 23rd July 2024 Time: 2 Hours

**Instructions**

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

**Question One (30 marks)**

(a) Differentiate between each of the following terms:
   (i) A real and a rational number. (2 marks)
   (ii) Domain and range of a function (2 marks)

(b) Solve the following inequality: $|6t + 10| \leq 3$ (3 marks)

(c) A company with four retail stores has 35 TVs *t*, 60 stereos *s*, 55 videocassette recorders *v* and 45 camcorders *c*, in store 1; 80*t*, 65*s*, 50*v*, and 38*c* in store 2; 29*t*, 36*s*, 24*v*, and 32*c* in store 3; and 62*t*, 49*s*, 54*v*, and 33*c* in store 4.
   (i) Express the present inventory in matrix form. (2 marks)
   (ii) The parent company sends out deliveries, $D = \begin{pmatrix} 8 & 6 & 9 & 5 \\ 4 & 7 & 5 & 2 \\ 6 & 3 & 0 & 8 \\ 5 & 9 & 7 & 4 \end{pmatrix}$ to its stores. What is the new level of inventory? (2 marks)

(d) A computer company must hire 25 programmers to handle systems programming jobs and 40 programmers to handle applications programming. Of those hired, 10 will be expected to perform jobs on both types. How many programmers must be hired? (3 marks)

(e) A company has a fixed cost of €8250 and a marginal cost of €450 for each item produced. If the company receives €800 for each item sold, how many items must it sell to make a profit of € 57 500 000? (4 marks)

(f) A retiree receives $ 5120 a year interest from $ 40, 000 placed in two bonds, one paying 14% and the other paying 12%. How much is invested in each bond? (4 marks)

(g) A firm wants to select a group of 8 out of its 20 employees to attend a business trip. In how many ways can this be done if there is a couple who must not be separated? (3 marks)

(h) What amount will an account have after 1.5 years if $ 8000 is invested at an annual rate of 9%:

(i) Compounded weekly (3 marks)

(ii) Compounded continuously (2 marks)

**Question Two (20 marks)**

(a) Of 32 people who save paper or bottles or both for recycling, 30 save paper and 14 save bottles. Find the number of those who:

(i) save both. (4 marks)

(ii) save only paper. (3 marks)

(iii) save only bottles. (3 marks)

(b) A survey on a sample of 25 new cars being sold by a local dealer was conducted to see which of the three popular options: air-conditioning (A), radio (R) and power windows (W) were already installed. The following results were obtained:

15 had air-conditioning
12 had radio
5 had air-conditioning and power windows
9 had air-conditioning and radio
4 had radio and power windows
3 had all the three options
2 had no options

(i) Find the number of cars that had exactly two options (3 marks)

(ii) Find the number of cars that had exactly one option (3 marks)

(iii) If the cars that had all the three options were sold at ksh. 1.2m, those with exactly two options installed were sold at ksh. 0.9m, with exactly one option were sold at ksh. 0.7m and with none of the options were sold at ksh. 0.5m, determine the total amount of money the dealer received from the sales if all the cars were sold. (4 marks)

**Question Three (20 marks)**

(a) A committee of six is to be formed from nine women and three men. In how many ways can the members be chosen if so as to include:

(i) exactly three men (3 marks)

(ii) at most five women (4 marks)

(b) Find the inverse of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{pmatrix}$ (5 marks)

(c) The sum of the third and the thirteenth terms of an arithmetic progression is 20. Find the sum of the first 15 terms of the sequence. (4 marks)

(d) Ram gives his son 100 dollars on one day, 50 dollars on the second day, 25 dollars on third day and so on. What will be total amount in 20 days? (4 marks)

**Question Four (20 marks)**

(a) A company produces three products, each of which must pass through three different departments. The table below shows the hour requirement of each product. The weekly capacity of each department is also given in terms of working hours.

| **Department** | **Product** | | | **Hours available per week** |
|---|---|---|---|---|
| | **I** | **II** | **III** | |
| A | 2 | 3.5 | 3 | 1200 |
| B | 3 | 2.5 | 2 | 1150 |
| C | 4 | 3 | 2 | 1400 |

(i) Form a system of linear equations to represent this information. (3 marks)

(ii) Solve the system in (i) above using any matrix method. (7 marks)

(b) Find the inverse of $g(x) = \frac{4x}{5x-7}$ (5 marks)

(c) Prove that $\sqrt{5}$ is not rational (5 marks)

**Question Five (20 marks)**

(a) A firm projects its profit to Ksh. 350 000 for the first month, Ksh. 700 000 for the second month, Ksh. 1 050 000 for the third month and so on. What will be the total projected profit at the end of $1\frac{1}{4}$ years? (4 marks)

(b) (i) A company wants to choose five men and six women to sit in the board. In how many ways can this be done if the choice is made from seven men and nine women? (3 marks)

(i) A company has 7 senior and 5 junior officers. An ad hoc legislative committee is to be formed. In how many ways can a four-officer committee be formed so that it is composed of at least two senior officers? (4 marks)

(c) A man borrows \$5 400 from a bank and agrees to repay it by paying \$ 300 per month to reduce the loan and 1.5% of the unpaid balance each month for the use of the money. What is the total cost of the loan over 18 months? (5 marks)

(d) Due to reduced taxes, a person has an extra \$1,200 in spendable income. If we assume that the person spends 65% of this on consumer goods, and the producers of these goods in turn spend 65% on consumer goods, and that this process continues indefinitely. What is the total amount spent on consumer goods to the nearest dollar? (4 marks)